anions of carboxyl groups, sulfonic acid groups and anions of sulfonic acid groups, and said inorganic particles are alumina or titania.

60. (Amended) The dispersion according to Claim 58, wherein said polymer particles have at least one functional group selected from the group consisting of cation-formable nitrogen-containing groups and cations of cation-formable nitrogen-containing groups, and said inorganic particles are selected from the group consisting of silica, zirconia and titania.

REMARKS

Claims 40-60 are active in the present application. Claims 44-60 are currently under prosecution. Claims 40-43 are non-elected claims. Independent Claims 44-60 have been amended for clarity. Amended Claims 44 and 58 now state that a plurality of inorganic particles are attached to the surface of each polymer particle. Support for the amendment is found in the Drawings, for example see Figure 2, Figure 12 or Figure 13. No new matter is added.

REQUEST FOR RECONSIDERATION

Applicants thank Examiner Deo for the helpful suggestion that the claims should recite that a plurality of inorganic particles are attached to the surface of each polymer particle. The claims have been amended for clarity. A plurality of inorganic particles are now recited to be attached to the surface of each polymer particle. The amended claims are supported by Figures 2, 12 and 13 wherein the polymer particle is shown surrounded by a plurality of inorganic particles.

The present invention is directed to an aqueous dispersion that contains polymer

particles, inorganic particles and water. The aqueous dispersion is useful in polishing and planarization applications, such as in the microelectronics industry. The inorganic particles and polymer particles have zeta potentials of opposite signs. Thus the particles are electrostatically attracted to one another to form aggregates. The aggregates contain polymer particles surrounded by inorganic particles which attach to the surface of the larger polymer particle. The polymer particles are thought to deform and flatten during polishing thus allowing the relatively small sized inorganic particles to contact the surface being polished (page 18, lines 17-20).

The claimed aqueous dispersion is demonstrated to offer significantly increased polishing rates. Embodiment 2E (page 50, line 28 through page 51, line 30) exemplifies an aqueous dispersion containing silica particles having a primary particle size of 200 Å and polystyrene particles having a primary particle size of 2000 Å. The polishing rate achieved using only silica particles is 1500 Å/min. The polishing rate of a dispersion containing only the polymer is negligible. When an aqueous dispersion containing both the silica particles (3.0 parts by weight) and the polystyrene particles (0.5 parts by weight) is used a polishing rate of 3500 Å/min is achieved (page 51, lines 15-18). Thus the combination of a polystyrene particle and silica particles more than doubles the polishing rate achievable with the silica particle alone.

The more than doubling achieved in polishing rate upon utilization of a combination of polymer and silica powder would not be expected to be realized through optimization of the prior art process through routine experimentation. Routine experimentation would at best be expected to yield a composition wherein the polishing rate of a mixture of abrasive particle and polymer particle are additive. The present application discloses a synergistic effect between polymer particle and inorganic particle.

The present claims were rejected under 35 U.S.C. §103(a) in view of a patent to Ronay (U.S. Patent No. 5,876,490) and further under 35 U.S.C. §103(a) in view of Ronay together with Hiroto (JP 152673), Hosali (U.S. Patent No. 5738800) or Skrovan (U.S. Patent No. 5,916,819).

The present invention is not obvious in view of the prior art cited since the superior polishing rates of a mixture containing both inorganic particles and polymer particles is not suggested by the prior art reference. The prior art cited teaches (i) compositions wherein abrasive particles are coated with polyelectrolyte and (ii) the combination of a polyelectrolyte and an abrasive particle inhibits the polishing rate of the abrasive particle. In essence, the polyelectrolyte of the prior art provides a means by which the polishing rate of the abrasive particle is retarded.

The Ronay patent describes slurry compositions that contain abrasive particles and polyelectrolytes, and wherein the abrasive particles are coated with the polyelectrolyte. The Ronay patent repeatedly states that the polyelectrolyte material adsorbs onto the surface of the abrasive particle (see for example column 3, lines 48-49, line 50, lines 66-67, column 4, line 14, column 5, line 12 and column 7, lines 11-12).

Present independent Claims 44 and 58 state that each polymer particle is attached to a plurality of inorganic particles and further contains a limitation that a ratio of the mean particle size of the polymer particles to the mean particle size of the inorganic particles is from 1 to 40. The prior art contains no such limitations nor does the prior art suggest that such a composition is favorable or may yield improved polishing rates or polishing performance in aqueous dispersions or slurries.

The Ronay patent nowhere mentions the dimensions of the polyelectrolyte (polymer) particle other than to say the submicron range is preferred. The size of the polymer particle

relative to the abrasive particle is not disclosed. The examples of the Ronay patent describe a poly(acrylic acid) species by its molecular weight. As has been stated in prior communications with the Office, the size of a particle is not necessarily a function of its molecular weight. No disclosure in the Ronay patent suggests to those of ordinary skill in the art to vary the size of the polymer particle with respect to the inorganic particle such that an aggregate is achieved wherein the polymer particle is surrounded with a plurality of inorganic particles.

Ronay combines the polyelectrolyte and abrasive particle to inhibit the polishing rate of the abrasive particle. The polyelectrolyte material is stated to reduce the polishing rate (Abstract line 3). In Ronay the polishing is achieved by abrasive particles that are not coated with the polyelectrolyte.

The Ronay patent teaches that the addition of a polyelectrolyte has exactly the opposite effect as that demonstrated in the present invention. The Ronay patent is, therefore, directly contradictory to the present invention where it is shown that the combination of a polymer and an abrasive material can yield polishing rates that may be more than twice the polishing rates achievable using the abrasive alone.

The disclosure in Hiroto, Hosali or Skrovan does not remedy the defects of the primary reference (Ronay) and cannot render the presently claimed invention obvious when combined with the primary reference.

In summary, Applicants submit that the presently claimed invention is not obvious in view of the Ronay patent given that (i) there is no disclosure in the Ronay patent that teaches or suggests preparing aqueous slurries wherein the polymer particle is surrounded by a plurality of inorganic particles, and (ii) the Ronay patent teaches the use of a polyelectrolyte to inhibit polishing rate and is thus directly contradictory to the present application where the

polymer particle is shown to <u>increase</u> polishing rate.

It is respectfully submitted that this amendment to the claims places all claims in condition for allowance. Applicants thus respectfully request the reconsideration and withdrawal of the outstanding rejections, and the passage of all now pending claims to Issue.

Respectfully submitted,

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MARKED-UP COPY AMENDMENT

IN THE CLAIMS

Please amend the claims as follows.

--44. (Amended) [An aqueous dispersion for chemical mechanical polishing used in the manufacture of semiconductor devices, said] A dispersion comprising polymer particles, inorganic particles and water, wherein the zeta potential of said polymer particles and the zeta potential of said inorganic particles are of opposite signs, and said polymer particles and said inorganic particles are electrostatically bonded to form composite particles, and

a plurality of said inorganic particles are attached to a surface of each of said polymer particles, and a ratio (Sp/Si) of a mean particle size of said polymer particles (Sp) and a mean particle size of said inorganic particles (Si) is from 1 to 40.

45. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 44 , wherein a ratio (Sp/Si) of a mean particle size of said polymer particles (Sp) and a mean particle size of said inorganic particles (Si) is from 1.5 to 20.

46. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 44, wherein a ratio (Wp/Wi) of a content of said polymer particles (Wp) and a content of said inorganic particles (Wi) is from 0.05 to 1.

47. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 44 , wherein said polymer

particles have at least one functional group selected from the group consisting of carboxyl groups, anions of carboxyl groups, sulfonic acid groups and anions of sulfonic acid groups, and said inorganic particles are alumina, titania, or combinations thereof.

48. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 47, wherein said inorganic particles are alumina, and the pH of said aqueous dispersion is from 2 to 9.

49. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 47, wherein said inorganic particles are titania, and the pH of said aqueous dispersion is from 2 to 6.

50. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 44, wherein said polymer particles have at least one functional group selected from the group consisting of cation-formable nitrogen-containing groups and cations of cation-formable nitrogen-containing groups, and at least one of said inorganic particles is selected from the group consisting of silica, zirconia and titania.

51. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 50, wherein said inorganic particles are silica, and the pH of said aqueous dispersion is from 2.5 to 8.5.

52. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 50, wherein said inorganic particles are zirconia, and the pH of said aqueous dispersion is from 4 to 8.5.

53. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 50, wherein said inorganic particles are titania, and the pH of said aqueous dispersion is from 6.5 to 8.5.

54. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 47, 48 or 49, wherein said polymer particles have at least one functional group selected from the group consisting of ester groups, amide groups, hydroxyl groups, and ether groups.

55. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 44, further comprising a surfactant, wherein a content of said surfactant is not greater than 0.15 wt%.

56. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 55, further comprising an oxidizing agent, a polyvalent metal ion, or combinations thereof.

57. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 56, further comprising an organic acid.

58. (Amended) [An aqueous dispersion for chemical mechanical polishing used in the manufacture of semiconductor devices, said] <u>A</u> dispersion comprising polymer particles, inorganic particles and water, wherein the zeta potential of said polymer particles and the zeta potential of said inorganic particles are of opposite signs, said polymer particles and said inorganic particles are electrostatically bonded to form composite particles, and a plurality of said inorganic particles are attached to a surface of <u>each of</u> said polymer particles, and a ratio (Sp/Si) of a mean particle size of said polymer particles (Sp) and a mean particle size of said inorganic particles (Si) is from 1 to 40, said composite particles are obtained after ultrasonic irradiation treatment or mechanical shear stress treatment with a homogenizer, and a mean particle size of said composite particles is not greater than 1μm.

59. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in

the manufacture of semiconductor devices] according to Claim 58, wherein said polymer particles have at least one functional group selected from the group consisting of carboxyl groups, anions of carboxyl groups, sulfonic acid groups and anions of sulfonic acid groups, and said inorganic particles are alumina or titania.

60. (Amended) The [aqueous] dispersion [for chemical mechanical polishing used in the manufacture of semiconductor devices] according to Claim 58, wherein said polymer particles have at least one functional group selected from the group consisting of cation-formable nitrogen-containing groups and cations of cation-formable nitrogen-containing groups, and said inorganic particles are selected from the group consisting of silica, zirconia and titania.

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